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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/596,373	12/16/2008	Aviram Tam	8873 USA P/PDC/CD-SEM/EZI	5794

57605 7590 04/21/2011

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EXAMINER	
CESE, KENNY	

ART UNIT	PAPER NUMBER
4174	

MAIL DATE	DELIVERY MODE
04/21/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/596,373	TAM ET AL.	
	Examiner	**Art Unit**	
	KENNY A. CESE	4174	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _09 June 2006_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-38_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-38_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _09 June 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statements (IDS) filed on 6/9/2006, 8/21/2006, and 8/24/2010 were considered and placed on the file of record by the examiner.

Specification

2. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

3. The abstract of the disclosure is objected to because the legal phraseology “consisting of” and “by means of”. Correction is required. See MPEP § 608.01(b).

4. The abstract of the disclosure is objected to because the following improper informalities, “eg.” and “The.” Correction is required.

5. The disclosure is objected to because of the following informalities: “Fig. 26” discussed in paragraphs 0023, 0024, 0028, 0029, 0031, and 0034 does not exist as a drawing. Examiner interprets “Fig. 26” as element 26 of Fig. 2.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 13 and 29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

8. Claim 13 recites “open figure” in line 2. The specification fails to provide adequate details to enable one skilled in the art to understand a limitation in the claim. The claimed “open figure” is not understood . For prior art consideration, the Examiner interprets “open figure” as a line.

9. Claim 29 is rejected as applied to claim 13.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. Claims 1-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyano (US 6,480,807) in view of Constantoudis et al. (Non-Patent Literature, titled, "Quantification of line-edge roughness of photoresists. II. Scaling and fractal analysis and the best roughness descriptors" April 25 2003; hereafter "Constantoudis").

Regarding claim 1, Miyano discloses a method for evaluating a feature, comprising: receiving an image of the feature (see col. 6 line 6-9); determining respective coordinates of a plurality of points on an edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image); fitting a figure having a non-circular non-linear shape to the plurality of points (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions and pattern).

Miyano does not particularly disclose determining respective distances between the plurality of points and the figure and computing a roughness parameter for the

feature in response to the respective distances. However, Constantoudis teaches determining respective distances between the plurality of points and the figure and computing a roughness parameter for the feature in response to the respective distances (see page 1020, where Constantoudis discusses computing edge roughness between distances of edge points at several positions).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing distance correlation. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by computing edge roughness between distances of edge points at several positions.

Regarding claim 2, Miyano and Constantoudis disclose computing the roughness parameter comprises computing a contact edge roughness (CER) in response to a sum of the squares of the respective distances and a number of degrees of freedom of the figure (see page 1020, where Constantoudis discusses computing edge roughness between distances of edge points at several positions).

Regarding claim 3, Miyano and Constantoudis disclose wherein computing the roughness parameter comprises computing a correlation length (CL) in response to a sum of the squares of the respective distances, a number of degrees of freedom of the

figure, and an average of squares of differences of the respective distances (see pages 1020-1023, where Constantoudis discusses computing the correlation length of edge points at several positions).

Regarding claim 4, Miyano and Constantoudis disclose wherein computing the roughness parameter comprises performing a Fourier analysis of the respective distances, and generating a power spectrum in response to the analysis (see figure 3 and pages 1020-1021, where Constantoudis discusses performing a Fourier transform and generating a spectrum based on edge data).

Regarding claim 5, Miyano and Constantoudis disclose wherein generating the power spectrum comprises filtering results of the Fourier analysis (see figure 3 and figure 4 and pages 1020-1022, where Constantoudis discusses performing a spectrum responses based on Fourier transform and filtering).

Regarding claim 6, Miyano and Constantoudis disclose discloses wherein filtering the results comprises selecting a filter in response to a process used to form the feature (see figures 19A and 19B and col. 8 lines 27-55, where Miyano discusses performing a Fourier transform based on roughness calculation process and page 1022, where Constantoudis discusses filter before the edge detection calculation).

Regarding claim 7, Miyano and Constantoudis disclose wherein the feature is formed on a substrate, and wherein the feature and the substrate are comprised in a semiconductor wafer (see col. 6 line 33-35, where Miyano discusses the elliptic hole pattern on a wafer, and see page 1019, where Constantoudis discusses scanning patterns on substrates).

Regarding claim 8, Miyano and Constantoudis disclose wherein the feature comprises a contact hole (see col. 6 line 33-35, where Miyano discusses the elliptic hole pattern on a wafer, therefore contact hole).

Regarding claim 9, Miyano and Constantoudis disclose wherein receiving the image comprises generating the image with a scanning electron microscope (see col. 5 lines 1-22, where Miyano discusses the scanning electron microscope used to obtain the image of the hole pattern).

Regarding claim 10, Miyano and Constantoudis disclose wherein the figure comprises an ellipse (see col. 6 lines 25-28, where Miyano discusses an elliptic hole pattern).

Regarding claim 11, Miyano and Constantoudis disclose wherein the figure has a known shape (see col. 6 lines 1-5, where Miyano uses predetermined measurement

position information, therefore known hole figure shapes and see col. 11 lines 37-42, where Miyano discusses a shape's predetermined function).

Regarding claim 12, Miyano and Constantoudis disclose wherein fitting the figure comprises determining a nominal shape of the figure by averaging at least some of the plurality of the points (see col. 6 lines 15-23, where Miyano discusses detecting edge portions and outputting information relating to a shape and see page 1023, where Constantoudis discusses averaging values calculated over many edges of the same structure).

Regarding claim 13, Miyano and Constantoudis disclose the figure is selected from a closed figure and an open figure (see col. 6 lines 15-23, where Miyano discusses detecting edge portions and outputting information relating to a shape and see page 1023, where Constantoudis discusses averaging values calculated over many edges of the same structure).

Regarding claim 14, Miyano and Constantoudis disclose wherein the distance is chosen from a perpendicular distance and a radial distance (see col. 7 lines 17-34, where Miyano discusses data acquired from perpendicular and radial lines).

Regarding claim 15, Miyano and Constantoudis disclose wherein the feature is chosen from a reticle, a part of the reticle, and a cast of a structure (see col. 5 lines 1-62

and col. 6 lines 29-39, where Miyano discusses scanning a wafer or portions of wafer in an electronic optical system).

Regarding claim 16, Miyano discloses a method for evaluating a feature, comprising: receiving an image of the feature (see col. 6 line 6-9); determining respective coordinates of a first plurality of points on a first edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image); fitting a first figure having a first non-circular non-linear shape to the first plurality of points (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions and pattern).

Miyano does not particularly disclose determining respective coordinates of a second plurality of points on a second edge of the feature in the image; fitting a second figure having a second non-circular non-linear shape to the second plurality of points; determining respective distances between the first and the second figures; and computing a roughness parameter for the feature in response to the respective distances.

However, Constantoudis teaches determining respective coordinates of a second plurality of points on a second edge of the feature in the image (see page 1020, where Constantoudis discusses acquiring positions of more than one edge points); fitting a second figure having a second non-circular non-linear shape to the second plurality of points (see page 1020); determining respective distances between the first and the

second figures (see page 1020); and computing a roughness parameter for the feature in response to the respective distances (see page 1020, where Constantoudis discusses computing edge roughness between distances of two edges).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing distance correlation between the first and the second figures. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by computing edge roughness between distances of edge points at several positions.

Regarding claim 17, Miyano discloses an apparatus for evaluating a feature, comprising: an imaging unit which is adapted to generate an image including the feature (see col. 6 line 6-9); and a processor (see col. 5 lines 60-65) adapted to: determine respective coordinates of a plurality of points on an edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image), fit a figure having a non-circular non-linear shape to the plurality of points (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions and pattern).

Miyano does not particularly disclose an image unit and a processor adapted to determine respective distances between the plurality of points and the figure and compute a roughness parameter for the feature in response to the respective distances. However, Constantoudis teaches determining respective distances between the plurality of points and the figure and computing a roughness parameter for the feature in response to the respective distances (see page 1020, where Constantoudis discusses computing edge roughness between distances of edge points at several positions).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing distance correlation. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by computing edge roughness between distances of edge points at different number of positions.

Regarding claim 18, Miyano and Constantoudis disclose computing the roughness parameter comprises computing a contact edge roughness (CER) in response to a sum of the squares of the respective distances and a number of degrees of freedom of the figure (see page 1020, where Constantoudis discusses computing edge roughness between distances of edge points at several positions).

Regarding claim 19, Miyano and Constantoudis disclose computing a correlation length (CL) in response to a sum of the squares of the respective distances, a number of degrees of freedom of the figure, and an average of squares of differences of the respective distances. (see pages 1020-1021-1023, where Constantoudis discusses computing the correlation length of edge points at several positions).

Regarding claim 20, Miyano and Constantoudis disclose the apparatus wherein computing the roughness parameter comprises performing a Fourier analysis of the respective distances, and wherein the processor is adapted to generate a power spectrum in response to the analysis (see figure 3 and pages 1020-1021, where Constantoudis discusses performing a Fourier transform and generating a spectrum based on edge data).

Regarding claim 21, Miyano and Constantoudis disclose the apparatus according to claim 20, wherein generating the power spectrum comprises filtering results of the Fourier analysis (see figure 3 and figure 4 and pages 1020-1022, where Constantoudis discusses performing a spectrum responses based on Fourier transform and filtering).

Regarding claim 22, Miyano and Constantoudis disclose the apparatus wherein filtering the results comprises selecting a filter in response to a process used to form the feature (see figures 19A and 19B and col. 8 lines 27-55, where Miyano discusses

performing a Fourier transform based on roughness calculation process and page 1022, where Constantoudis discusses filter before the edge detection calculation).

Regarding claim 23, Miyano and Constantoudis disclose the apparatus wherein the feature is formed on a substrate and wherein the substrate and the feature are comprised in a semiconductor wafer (see col. 6 lines 33-35, where Miyano discusses the elliptic hole pattern on a wafer and see 1019, where Constantoudis discusses scanning patterns on substrates).

Regarding claim 24, Miyano and Constantoudis disclose the apparatus wherein the feature comprises a contact hole (see col. 6 line 33-35, where Miyano discusses the elliptic hole pattern on a wafer, therefore contact hole).

Regarding claim 25, Miyano and Constantoudis disclose the apparatus wherein the imaging unit and the processor are comprised in a scanning electron microscope (see col. 5 lines 1-22, where Miyano discusses the scanning electron microscope used to obtain the image of the hole pattern).

Regarding claim 26, Miyano and Constantoudis disclose the apparatus wherein the figure comprises an ellipse (see col. 6 lines 25-28, where Miyano discusses an elliptic hole pattern).

Regarding claim 27, Miyano and Constantoudis disclose the apparatus wherein the figure has a known shape (see col. 6 lines 1-5, where Miyano uses predetermined measurement position information, therefore known hole figure shapes and see col. 11 lines 37-42, where Miyano discusses a shape's predetermined function).

Regarding claim 28, Miyano and Constantoudis disclose the apparatus wherein the processor is adapted to determine a nominal shape of the figure by averaging at least some of the plurality of the points (see col. 6 lines 15-23, where Miyano discusses detecting edge portions and outputting information relating to a shape and see page 1023, where Constantoudis discusses averaging values calculated over many edges of the same structure).

Regarding claim 29, Miyano and Constantoudis disclose wherein the figure is selected from a closed figure and an open figure (see col. 6 lines 15-23, where Miyano discusses detecting edge portions and outputting information relating to a shape and see page 1023, where Constantoudis discusses averaging values calculated over many edges of the same structure).

Regarding claim 30, Miyano and Constantoudis disclose wherein the distance is chosen from a perpendicular distance and a radial distance (see col. 7 lines 17-34, where Miyano discusses data acquired from perpendicular and radial lines).

Regarding claim 31, Miyano and Constantoudis disclose the apparatus wherein the feature is chosen from a reticle, a part of the reticle, and a cast of a structure (see col. 5 lines 1-62 and col. 6 lines 29-39, where Miyano discusses scanning a wafer or portions of wafer in an electronic optical system).

Regarding claim 32, Miyano discloses the apparatus for evaluating a feature, comprising: an imaging unit which is adapted to generate an image including the feature (see col. 6 line 6-9); and a processor which is adapted to: determine respective coordinates of a first plurality of points on a first edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image), fit a first figure having a first non-circular non-linear shape to the first plurality of points (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions and pattern).

Miyano does not particularly disclose an processor which is adapted to determine respective coordinates of a second plurality of points on a second edge of the feature in the image, fit a second figure having a second non-circular non-linear shape to the second plurality of points, determine respective distances between the first and the second figures, and compute a roughness parameter for the feature in response to the respective distances.

However, Constantoudis teaches an processor which is adapted to determine respective coordinates of a second plurality of points on a second edge of the feature in

the image (see page 1020, where Constantoudis discusses acquiring positions of more than one edge points); fit a second figure having a second non-circular non-linear shape to the second plurality of points (see page 1020); determine respective distances between the first and the second figures (see page 1020); and compute a roughness parameter for the feature in response to the respective distances (see page 1020, where Constantoudis discusses computing edge roughness between distances of two edges).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing distance correlation between the first and the second figures. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by computing edge roughness between distances of edge points at several positions.

Regarding claim 33, Miyano discloses a method for evaluating a feature, comprising: receiving an image of the feature (see col. 6 line 6-9); determining respective coordinates of a plurality of points on an edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image), fitting a figure to the plurality of points (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the

pattern based on the edge portions and extracting a feature based on edge portions), determining respective distances between the plurality of points and the figure (see col. 7 lines 24-46, where Miyano discusses obtaining line and angle measurements and calculating density information for each edge region).

Miyano does not particularly disclose computing a correlation length in response to a sum of the squares of the respective distances, a number of degrees of freedom of the figure, and an average of squares of differences of the respective distances. However, Constantoudis teaches computing a correlation length in response to a sum of the squares of the respective distances, a number of degrees of freedom of the figure, and an average of squares of differences of the respective distances (see pages 1020-1021, where Constantoudis discusses computing the correlation length of edge points at several positions).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing distance correlation. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by calculating the correlation length of edge points at several positions.

Regarding claim 34, Miyano discloses method for evaluating a feature, comprising: receiving an image of the feature (see col. 6 line 6-9); determining

respective coordinates of a plurality of points on an edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image); fitting a figure to the plurality of points (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions).

Miyano does not particularly disclose determining respective distances between the plurality of points and the figure; performing a Fourier analysis of the respective distances and filtering results of the Fourier analysis in response to a process used to form the feature. However, Constantoudis teaches determining respective distances between the plurality of points and the figure (see pages 1020-1021, where Constantoudis discusses computing the correlation length of edge points at different positions), performing a Fourier analysis of the respective distances and filtering results of the Fourier analysis in response to a process used to form the feature (see figure 3 and pages 1020-1022, where Constantoudis discusses performing a Fourier transform, generating a spectrum based on edge data, and filtering).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing Fourier analysis with respective to calculated distances. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a

roughness parameter by calculating the correlation length of edge points at different positions and performing Fourier analysis.

Regarding claim 35, Miyano discloses a method for evaluating a feature, comprising: receiving an image of the feature (see col. 6 line 6-9); determining respective coordinates of a plurality of points on an edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image); fitting a figure to the plurality of points; (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions).

Miyano does not particularly disclose determining respective distances between the plurality of points and the figure; performing a Fourier analysis of the respective distances and filtering results of the Fourier analysis in response to a shape of the feature. However, Constantoudis teaches determining respective distances between the plurality of points and the figure (see pages 1020-1021, where Constantoudis discusses computing the correlation length of edge points at different positions); performing a Fourier analysis of the respective distances and filtering results of the Fourier analysis in response to a shape of the feature (see figure 3 and pages 1020-1022, where Constantoudis discusses performing a Fourier transform, generating a spectrum based on edge data, and filtering).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness

by implementing Fourier analysis with respective to calculated distances. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by calculating the correlation length of edge points at different positions and performing Fourier analysis.

Regarding claim 36, Miyano discloses an apparatus for evaluating a feature, comprising: an imaging unit which is adapted to generate an image including the feature (see col. 6 line 6-9); and a processor which is adapted to: determine respective coordinates of a plurality of points on an edge of the feature in the image (see figure 17, figure 18, and col. 6 lines 15-20, where Miyano discusses detecting edge portions of a pattern from an image), fit a figure to the plurality of points (see col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions).

Miyano does not particularly disclose a processor adapt to determine respective distances between the plurality of points and the figure, and compute a correlation length in response to a sum of the squares of the respective distances, a number of degrees of freedom of the figure, and an average of squares of differences of the respective distances.

However, Constantoudis teaches to determine respective distances between the plurality of points and the figure (see pages 1020-1021, where Constantoudis discusses

computing the correlation length of edge points at different positions), and compute a correlation length in response to a sum of the squares of the respective distances, a number of degrees of freedom of the figure, and an average of squares of differences of the respective distances (see pages 1020-1021, where Constantoudis discusses computing the correlation length of edge points at several positions).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing distance correlation. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by calculating the correlation length of edge points at several positions.

Regarding claim 37, Miyano discloses an apparatus for evaluating a feature, comprising: an imaging unit which is adapted to generate an image including the feature (see col. 6 line 6-9); and a processor which is adapted to: determine respective coordinates of a plurality of points on an edge of the feature in the image, fit a figure to the plurality of points (see figure 17, figure 18, and col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions).

Miyano does not particularly disclose a processor adapt to determine respective distances between the plurality of points and the figure, perform a Fourier analysis of

the respective distances, and filter results of the Fourier analysis in response to a process used to form the feature. However, Constantoudis teaches to determine respective distances between the plurality of points and the figure (see pages 1020-1021, where Constantoudis discusses computing the correlation length of edge points at different positions), perform a Fourier analysis of the respective distances (see figure 3 and pages 1020-1022), and filter results of the Fourier analysis in response to a process used to form the feature (see figure 3 and pages 1020-1022, where Constantoudis discusses performing a Fourier transform, generating a spectrum based on edge data, and filtering).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing Fourier analysis with respective to calculated distances. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by calculating the correlation length of edge points at different positions and performing Fourier analysis.

Regarding claim 38, Miyano discloses an apparatus for evaluating a feature, comprising: an imaging unit which is adapted to generate an image including the feature (see col. 6 line 6-9); and a processor which is adapted to: determine respective coordinates of a plurality of points on an edge of the feature in the image, fit a figure to

the plurality of points (see figure 17, figure 18, and col. 6 lines 20-24 and col. 8 lines 5-9, where Miyano discusses determining the shape of the pattern based on the edge portions and extracting a feature based on edge portions).

Miyano does not particularly disclose to determine respective distances between the plurality of points and the figure, perform a Fourier analysis of the respective distances, and filter results of the Fourier analysis in response to a shape of the feature. However, Constantoudis teaches to determine respective distances between the plurality of points and the figure (see pages 1020-1021, where Constantoudis discusses computing the correlation length of edge points at different positions), perform a Fourier analysis of the respective distances (see figure 3 and pages 1020-1022), and filter results of the Fourier analysis in response to a shape of the feature (see figure 3 and pages 1020-1022, where Constantoudis discusses performing a Fourier transform, generating a spectrum based on edge data, and filtering).

It would have been obvious at the time of the invention was made to one of ordinary skill in the art to modify the invention of Miyano, and examine edge roughness by implementing Fourier analysis with respective to calculated distances. Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the combined teachings of Miyano and Constantoudis as a whole to derive at the claimed invention in order to evaluate a roughness parameter by calculating the correlation length of edge points at different positions and performing Fourier analysis.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Yamaguchi et al. (US 200310021463) discussing X and Y coordinates of the right and left edge points of an image feature, and calculating the degree of edge roughness correlation of left and right figures.

Leunissen et al. (Non-Patent Literature, titled, “Line edge roughness: experimental results related to a two-parameter model,” March 2004) discussing line edge roughness calculation with respect to distance.

Contact Information

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